

# THE INTESTINAL PROTOZOA OF NON-DYSENTERIC CASES

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## CONTENTS

	PAGE
I. INTRODUCTION ... ..	361
II. GENERAL RESULTS	
NUMBER OF EXAMINATIONS ... ..	362
DISCUSSION OF GENERAL RESULTS ... ..	364
III. SPECIAL ASPECTS OF THE RESULTS	
A. THE RELATION OF THE INFECTIONS TO THE DISEASES SUFFERED BY THE PATIENTS ... ..	367
B. DISTRIBUTION OF THE INFECTIONS BETWEEN PATIENTS WITH PREVIOUS HISTORY OF DYSENTERY OR DIARRHOEA AND PATIENTS WITH NO SUCH HISTORY ... ..	368
C. CLASSIFICATION OF PATIENTS ACCORDING TO THE REGIONS IN WHICH THEY HAVE TRAVELLED ... ..	370
D. DETAILED HISTORIES OF PATIENTS HAVING INFECTIONS OF <i>E. histolytica</i> . DISCUSSION OF THESE SPECIAL CASES ... ..	372
E. DETAILED HISTORIES OF PATIENTS HAVING INFECTIONS OF <i>Entamoeba coli</i> APPARENTLY CONTRACTED IN ENGLAND OR IN CANADA ... ..	384
F. DETAILED HISTORIES OF PATIENTS WHO HAVE NEVER BEEN OUT OF ENGLAND AND WHO HAVE INFECTIONS OF <i>Giardia (Lambli)a</i> <i>intestinalis</i> ... ..	386
G. ORGANISMS FOUND OTHER THAN PROTOZOA ... ..	389

## I. INTRODUCTION

While working at the Liverpool School of Tropical Medicine on the protozoa of patients suffering from dysentery, we have had the opportunity of examining also a number of patients for intestinal protozoa who entered hospital for diseases other than dysentery. The present paper gives the results of the examination of 250 such non-dysenteric patients, and the work is being continued. The diseases for which the patients entered hospital were very varied, including wounds, malaria, gastric troubles of various kinds, throat and ear complaints, appendicitis, hernia, haemorrhoids, and many others. We have not included in our results any examinations of

patients who entered hospital for dysentery. The stools were examined for intestinal protozoa in the usual way,\* and the following results were obtained :—

## II. GENERAL RESULTS

Total number of patients examined ... .. 250

Number of patients having protozoal infections 75 = 30 %

The following table shows the composition of the 75 positive cases :—

TABLE I.

	No. of cases	Percentage of all cases	Pure infection	Mixed infection
<i>Entamoeba histolytica</i> ... ..	20	8.0	5	15
<i>Entamoeba coli</i> ... ..	48	19.2	34	14
<i>Giardia</i> (= <i>Lambli</i> a) <i>intestinalis</i> ... ..	20	8.0	14	6
<i>Chilomastix</i> (= <i>Tetramitus</i> ) <i>mesnili</i> ... ..	5	2.0	1	4
<i>Trichomonas hominis</i> ... ..	4	1.7	3	1

THE DOUBLE INFECTIONS WERE :—

*E. histolytica* and *E. coli* in 8 cases

*E. histolytica* and *Lambli*a in 3 cases

*E. histolytica* and *Trichomonas* in 1 case

*E. coli* and *Tetramitus* in 2 cases

*E. coli* and *Lambli*a in 1 case

THE TRIPLE INFECTIONS WERE :—

*E. histolytica*, *E. coli* and *Tetramitus* in 1 case

*E. histolytica*, *E. coli* and *Lambli*a in 1 case

THERE WAS ONE QUADRUPLE INFECTION, VIZ :—

*E. histolytica*, *E. coli*, *Lambli*a and *Tetramitus*

### NUMBER OF EXAMINATIONS

There is at present very little published evidence indicating how many examinations of an infected patient's stool are necessary before his infection can be discovered with certainty. We give in another paper in this number (p. 411) a statistical examination of evidence we have obtained upon this point in the case of patients suffering from dysentery. The significance of those figures is there fully discussed. Here it is sufficient to say that the results show the desirability of making at least three examinations of each patient

\* *Vide* p. 412 of this Volume.

before giving any opinion regarding the infection of those found negative in these examinations. The difficulties of collection in the case of these non-dysenteric patients, where examination of the stools of the patients was no part of the regular work of the hospital, prevented us from obtaining three examinations in every case. The following are the numbers of examinations actually obtained:—

- 250 patients were examined at least once.
- 155 patients were examined at least twice.
- 74 patients were examined at least three times.
- 41 patients were examined at least four times.
- 37 patients were examined at least five times.
- 28 patients were examined at least six times.

As only 74 patients were examined three times, it is certain that the number of infections given in our table is too low. We ought to say that *at least* the given number of infections occurred. We can, perhaps, give an approximate idea by how many our positive cases would have been increased if we had examined each one twice, and also if we had examined each one three times.

We know from data given in Table II that of the 155 patients examined twice, nine new infections were found on the second examination. At this rate the 95 patients who were only examined once should have produced five or six new infections in the second examination, making a total of 80 positive cases and raising the percentage of positives to 32 per cent. instead of 30 per cent. as at present. Besides raising the total number of positives, this second examination would have added on the same assumption new protozoa in cases which were already positive, and thus increased the number of double and triple infections. No new infection was found on the third examination, though new protozoa were found in patients who already had an infection. We found, indeed, that both second, third, fourth, and in rare cases subsequent examinations, added new protozoa, usually *Entamoeba coli*, which is apparently the most sporadic in its occurrence. It follows that though the third and subsequent examinations rarely add an entirely new infection, yet the percentage of a particular protozoon, usually *E. coli*, and along with it the number of double or triple infections may be somewhat increased, and, of course, the number of pure infections correspondingly lowered.

The actual figures showing how (a) the entirely new infections, (b) the findings of *E. coli*, (c) of *E. histolytica*, and (d) of *Lambli*a increased with repeated examinations are given in Table II.

TABLE II.

No. of patients examined	No. of examination	(a)		(b)		(c)		(d)	
		Infections of any sort found	Additional new infections	Infections of <i>E. coli</i> found	Additional infections of <i>E. coli</i>	Infections of <i>E. histolytica</i> found	Additional infections of <i>E. histolytica</i>	Infections of <i>Lambli</i> a found	Additional infections of <i>Lambli</i> a
250	1st	65	—	32	—	17	—	14	—
155	2nd	74	9	43	11	19	2	20	6
74	3rd	74	—	44	1	20	1	20	—
41	4th	75	1	46	2	20	—	20	—
37	5th	75	—	47	1	20	—	20	—
28	6th	75	—	47	—	20	—	20	—
27	7th	75	—	48	1	20	—	20	—

Of the eleven new infections of *E. coli* found on the second examination, only six were found in men who had previously been entirely negative. The remaining five went to swell the number of mixed infections, some other protozoon already being present.

#### DISCUSSION OF GENERAL RESULTS

Before proceeding to make certain comparisons which suggest themselves, it will be well to emphasise the broad general result that in a considerable percentage of non-dysenteric patients infections of intestinal protozoa are present. This result might perhaps have been expected in the case of *E. coli*, which is well known to be harmless and widespread. That so many infections should occur in non-dysenterics of *E. histolytica*, *Lambli*a, *Trichomonas* and *Tetramitus*, one of which certainly, and all of which possibly cause forms of dysentery, is a fact of some significance.

On account of their pathogenic importance, the infections of *E. histolytica* are of greatest interest. We wish we could have examined many more patients so as to have more reliable figures on this point. It is, however, highly significant that so many as



8 per cent. of a mixed population of non-dysenteric cases should be carriers of amoebic dysentery. The figures become even more significant when we consider that more than half of the 250 patients examined have never been out of strictly temperate regions, and therefore presumably have not been exposed to infection by *E. histolytica*, or only in the very slightest degree. In Table VII, p. 370, it is shown that of the 250 patients examined, only 123 had been in tropical or sub-tropical regions. If we consider only these 123 who have been in districts where *E. histolytica* is prevalent, the percentage of carriers of amoebic dysentery among them becomes 15.4. That this high percentage of positive cases should exist among those who have been exposed to infection and who are not suffering from dysentery is, we consider, perhaps the most striking result of our investigations. It is confirmed by the results of Dobell (1916), who examined 200 patients who had come from Gallipoli and Egypt, and had therefore been in an area where *E. histolytica* is endemic. Of these, 110 were non-dysenteric cases, and therefore strictly comparable with our 123 patients whose infections have just been given.

	Dobell	Smith and Matthews
Number of non-dysenteric patients from an area where <i>E. hist.</i> is endemic ... ..	110	123
Percentage of <i>E. histolytica</i> carriers ... ..	11.8 %	15.4 %
Number of these patients suffering from intestinal complaints ... ..	40	21
Percentage of <i>E. histolytica</i> carriers in these ...	5 %	4.8 %
Number suffering from non-intestinal complaints...	70	102
Percentage of <i>E. histolytica</i> carriers in these ...	15.7 %	17.6 %

Of our twenty *E. histolytica* cases, three had a history of dysentery, and are therefore what Dobell has called convalescent

carriers. Seventeen had no history of dysentery, and are what he has termed contact carriers. We believe that no such large number of 'contact carriers' has previously been recorded.

No separate records for non-dysenteric cases are given by Jepps (1916), but she finds 7.75 per cent. of 426 patients are carriers of *E. histolytica*. The greater proportion of these were found among dysenteric cases, and therefore the percentage of carriers of *E. histolytica* among the non-dysenteric cases must have been smaller than 7.75 per cent. All these men had been in an area where *E. histolytica* is endemic, and all were intestinal cases, so that among a certain number of non-dysenteric patients with intestinal complaints from an area where *E. histolytica* is endemic she found a percentage of *E. histolytica* carriers smaller than 7.75 per cent. It was, in fact, probably quite near our own 4.8 per cent. and Dobell's 5 per cent. in a strictly similar category.

Barratt (1916) records among forty-one non-dysenteric patients who have been exposed to infection by *E. histolytica* no cases of carriers of *E. histolytica*. This result we cannot understand, unless it was due to an insufficient number of examinations.

We will next compare our figures with those obtained by the examination of patients suffering from dysentery, and will refer to two sets of results: (1) those given by Wenyon (1916) from an examination of 556 cases of dysentery, (2) Liverpool results given in another paper in this journal (p. 411) from an examination of 910 cases of dysentery.

TABLE III.

	Wenyon's dysenteric cases	Liverpool dysenteric cases	Our own non-dysenteric cases
			From Table I, col. 2
<i>Ent. histolytica</i> ... ..	10.8 %	10.3 %	8.0 %
<i>E. coli</i> ... ..	39.0 %	25.4 %	19.2 %
<i>Lamblia</i> ... ..	16.0 %	18.6 %	8.0 %
<i>Tetramitus</i> ... ..	0.5 %	2.7 %	2.0 %
<i>Trichomonas</i> ... ..	1.6 %	1.2 %	1.7 %

The figures for non-dysenteric patients show a smaller number of infections for each of the common intestinal protozoa. This was perhaps to be expected and it would seem more worthy of note that the number of parasitic infections should so nearly approach that found in dysenteric patients. Especially is this the case with *E. histolytica*, where the percentage of infections is quite of the same order of magnitude as that found in dysenteric patients.

A very brief reference to some results which may afford comparison with our own is to be found in a paper by Hall (1916). The paper is mainly concerned with the bacteriology of paratyphoid, but the following incidental reference is made to intestinal protozoa. 'Further we had found that 10 per cent. of the paratyphoid cases showed a heavy infection with *E. histolytica*, 22 per cent. with *E. coli*, and in the last series 9 per cent. with *Lambia*.' These figures for a special class of patient are similar to those found by us for patients of all classes.

The number of double infections is rather small to draw safely any deductions from their composition. It may, however, be noted that the commonest double infection is *E. histolytica* and *E. coli*. This is also the case in the very much larger series of results obtained from dysenteric patients both by Wenyon and in this laboratory.

### III. SPECIAL ASPECTS OF THE RESULTS

#### A. THE RELATION OF THE INFECTIONS TO THE DISEASES SUFFERED BY THE PATIENTS

We thought it of some value, considering that the intestinal protozoa would naturally be expected to be connected with diseases of the intestine, to divide the patients examined into two classes, according as they entered hospital suffering from intestinal or from non-intestinal diseases. The results are given in Table IV.

It is, of course, undesirable to lay too much stress upon figures obtained from so small a number as forty-eight, the number of intestinal cases examined, but it is at least of some significance that the total percentage of infections is not greater in the case of the patients suffering from intestinal complaints, but rather less. As far as any stress can be laid upon such small numbers, this is true of

TABLE IV.

Patients suffering from intestinal complaints				Patients suffering from non-intestinal complaints			
Number of cases examined	...	...	48	Number of cases examined	...	...	202
Protozoal infections found in	...	...	12 = 25.0%	Protozoal infections found in	...	...	63 = 31.2%
		No. of cases				No. of cases	
<i>E. histolytica</i>	...	1	= 2.1%	<i>E. histolytica</i>	...	19	= 9.4%
<i>E. coli</i>	...	2	= 4.2%	<i>E. coli</i>	...	46	= 22.8%
<i>Lamblia</i>	...	6	= 12.5%	<i>Lamblia</i>	...	14	= 6.9%
<i>Tetramitus</i>	...	1	= 2.1%	<i>Tetramitus</i>	...	4	= 2.0%
<i>Trichomonas</i>	...	2	= 4.2%	<i>Trichomonas</i>	...	2	= 1.0%

the amoebic infections also. It is, indeed, very striking that of the twenty infections of *E. histolytica* only one should be found in a patient suffering from an intestinal complaint, and of the forty-eight infections of *E. coli* only two should be in the same category.

#### B. DISTRIBUTION OF THE INFECTIONS BETWEEN PATIENTS WITH PREVIOUS HISTORY OF DYSENTERY OR DIARRHOEA AND PATIENTS WITH NO SUCH HISTORY

Although none of the patients were in hospital for dysentery, yet some had a previous history of dysentery, and it was thought to be desirable to separate these out (Table V).

It may be pointed out again that the number of patients with a history of dysentery is small, and it would be unsafe to draw any detailed deductions from the results. It seems to us, however, significant and surprising that the percentage of *E. histolytica* cases among those who have had dysentery is so little greater than among those who have not had dysentery. It appears that, at any rate, a significant percentage of men become carriers of *E. histolytica* without having had any dysentery at all. If our dysenteric cases were more numerous, and the same percentages still held good, we might be able to say that the number of such carriers was little less than the number of those in whom *E. histolytica* caused dysentery. This

TABLE V.

History of Dysentery				No history of dysentery			
Number of cases examined ... .. 30				Number of cases examined ... .. 220			
Protozoal infections found in ... .. 12 = 40%				Protozoal infections found in ... .. 63 = 28.6%			
		No. of cases				No. of cases	
<i>E. histolytica</i>	...	3	= 10.0%	<i>E. histolytica</i>	...	17	= 7.7%
<i>E. coli</i>	...	9	= 30.0%	<i>E. coli</i>	...	39	= 17.7%
<i>Lambliia</i>	...	2	= 6.7%	<i>Lambliia</i>	...	18	= 8.2%
<i>Tetramitus</i>	...	1		<i>Tetramitus</i>	...	4	
<i>Trichomonas</i>	...	1		<i>Trichomonas</i>	...	3	

deduction must be withheld for the present, however, owing to the small number of cases examined having a history of dysentery. Considering the view held by some that *Lambliia* is a cause of dysentery, we think it significant that all the *Lambliia* cases but two are found among those with no previous history of dysentery.

We also ascertained which patients had a previous history of diarrhoea, and in Table VI we compare those whose record is entirely free from either dysentery or diarrhoea with those who have had one of these ailments. We include in the first column those who have had diarrhoea in a mild form, not persistent or acute diarrhoea only. The information on this point was obtained by questioning the patients, and diarrhoea was recorded in any case in which the patient could remember having had it.

In each category we have examined over 100 patients, and therefore the figures for the main infections are probably reliable. Though both *E. histolytica* and *E. coli* are found to be somewhat more prevalent among patients with a previous history of dysentery or diarrhoea, yet the main fact to be deduced from this table is the presence of a very considerable number of infections among patients who have no history of either dysentery or diarrhoea. It is noteworthy that *Lambliia* infections are equally prevalent among patients



TABLE VI.

History of dysentery or diarrhoea			No history of dysentery or diarrhoea		
Number of cases examined ... ..	110		Number of cases examined ... ..	140	
Protozoal infections found in ... ..	$\frac{35}{100}$ = 31·8%		Protozoal infections found in ... ..	$\frac{40}{100}$ = 28·6%	
	No. of cases			No. of cases	
<i>E. histolytica</i> ... ..	11 = 10%		<i>E. histolytica</i> ... ..	9 = 6·4%	
<i>E. coli</i> ... ..	24 = 21·8%		<i>E. coli</i> ... ..	24 = 17·1%	
<i>Lamblia</i> ... ..	9 = 8·2%		<i>Lamblia</i> ... ..	11 = 7·9%	
<i>Tetramitus</i> ... ..	2		<i>Tetramitus</i> ... ..	3	
<i>Trichomonas</i> ... ..	2		<i>Trichomonas</i> ... ..	2	

who have no record whatever of diarrhoea, even in its mildest form. This fact has an important bearing upon the question of whether *Lamblia* causes dysentery or diarrhoea.

### C. CLASSIFICATION OF PATIENTS ACCORDING TO THE REGIONS IN WHICH THEY HAVE TRAVELLED

We obtained from the patients particulars of their residence abroad and of their travels, and in the following table are given particulars of the patients from this point of view:—

TABLE VII.

	Resided or travelled in tropical or sub-tropical regions	In France and England only	In Canada and England only	In England only
Number of cases examined	123	91	12	24
Protozoal infections found in	$\frac{40}{100}$ = 32·5%	$\frac{28}{100}$ = 30·8%	2	$\frac{5}{100}$ = 20·8%
	No. of cases	No. of cases	No. of cases	No. of cases
<i>E. histolytica</i>	19 = 15·4%	1 = 1·2%	—	—
<i>E. coli</i> ...	23 = 18·7%	21 = 23·1%	2	2
<i>Lamblia</i> ...	10 = 7·1%	7 = 8·4%	—	3
<i>Tetramitus</i> ...	5	—	—	—
<i>Trichomonas</i>	4	—	—	—

The first column, i.e., those who have resided or travelled in tropical or sub-tropical regions, includes those who have resided for longer or shorter periods in tropical Africa, India, tropical America, Mesopotamia and in the Mediterranean region, which comprised in our records, Egypt, Gallipoli and the Salonika district. In the case of sailors there was no prolonged residence in any of these districts. In the case of soldiers the residence was usually for periods of a month to two years.

Those in the second column were soldiers, and were thus exposed to conditions quite unlike those of ordinary residence in France. They were in some cases exposed to contact with native troops from tropical and sub-tropical regions, and also with British troops who had previously been in Egypt and Gallipoli.

If we consider the results set forth in columns 1, 2 and 4 of Table VII, ignoring column 3 which contains too few cases, we see that the percentage of infections of any kind falls off a little when the patients are drawn from a temperate rather than a tropical or sub-tropical region, and another fall occurs when the region is England only.

The striking fact, however, which is brought out by this table is that the *kind* of infection differs most significantly as we pass from a tropical or sub-tropical region to a strictly temperate one. With one exception, no infection of *E. histolytica*, *Tetramitus* or *Trichomonas* has been obtained in the temperate regions of Northern France, England and Canada. A much more varied intestinal fauna is at once seen in patients who have been in tropical or sub-tropical countries, and it is from these regions almost alone that the pathogenic *E. histolytica* is obtained. The case of the patient who forms the one exception to this generalisation is discussed more fully later in this paper.\* *Entamoeba coli* seems to be prevalent in all regions, both tropical, sub-tropical, and temperate, and the same may be said of *Lamblia intestinalis*.

That infections should be found at all in patients who have never been out of England, or of England and Canada, is perhaps a fact sufficiently striking to merit further notice. We have given in a

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\* We have lately diagnosed with certainty another *E. histolytica* case from France about which up to the time of writing this paper we had been doubtful. A note on this case is appended at the end of Section D, page 383.

previous paper, Smith and Matthews (1916), a brief account of the three infections of *Lambli*a which appear to have been obtained in England, and to these cases we make further reference in a later part of this paper. We also give later a special account of the infections of *E. coli* which have apparently been contracted in this country or in Canada.

#### D. DETAILED HISTORIES OF PATIENTS HAVING INFECTIONS OF *E. HISTOLYTICA*. DISCUSSION OF THESE SPECIAL CASES

Before discussing the special *E. coli* and *Lambli*a infections just referred to, we consider the cases having an infection of *E. histolytica* to be so important, and the record of examinations made so interesting, that we here give a brief account of each patient's history, and in some cases an accompanying table to show the results of our observations.

CASE 2. The patient had spent a considerable part of his life at sea, having been in the Mediterranean area for six years, and in the region of the East Indies for two years. In 1905 he returned from the East Indies to England, where he resided till 1914, when he again went to sea, but remained entirely in northern latitudes. On 26 May, 1916, he was sent into hospital suffering from gun deafness. The patient stated he had never at any time suffered from diarrhoeic conditions but was rather inclined to be constipated.

Cysts of *E. histolytica* were not found in the stools till the third examination, and although the case was followed regularly for some time, only on two subsequent examinations were they again found. Cysts of *E. coli* were found twice.

When we consider the patient's history, we think it probable that he may have contracted the infection while stationed in tropical parts of the world, and that he may have been a carrier of *E. histolytica* for several years.

The record of examinations made is as follows:—

Date. 1916 .....	June								July						
	20	21	24	26	27	28	30	1	3	4	5	6	7		
<i>E. histolytica</i> cysts ...	—	—	+	—	—	—	+	—	—	+	—	—	—		

+ = scanty infection.

CASE 10. The patient, before the outbreak of war, was a fisherman in the North Sea, going out from fishing towns on the north-east coast. During 1915 and 1916 he was engaged on a vessel running between England and Port Said, but before this he had never left English waters. On one occasion while ashore in Egypt the patient had an attack of diarrhoea with four or five stools a day, but never passed any blood or mucus. He blamed the drinking water.

In June 1916 he was admitted to hospital suffering from asthma and bronchitis, and by this time the diarrhoeic conditions had disappeared.

On microscopic examination of the stools being made, they were found to contain fairly large numbers of the cysts of *E. histolytica*. On one occasion the infection was very heavy, and only on three out of the fourteen examinations made were no cysts found. Cysts of *E. coli* occurred three times, and *E. coli* amoebae were observed once. Compared with Case 2, the date when this patient contracted the infection is probably much more recent, and almost certainly when he was in Egypt. The results of our examinations are shown in the following table:—

Date. 1916.	June							July						
	22	23	24	26	27	28	29	30	1	3	4	5	6	7
<i>E. histolytica</i>														
cysts .....	++	+++	+++	+	-	-	+	++	+	-	+	++	+	+
	+ = scanty.			++ = medium.			+++ = heavy infection.							
	Scanty infection = about 10 cysts per cover-slip preparation.													
	Medium infection = about 30 cysts per cover-slip preparation.													
	Heavy infection = above 100 cysts per cover-slip preparation.													

CASE 21. The patient had spent twelve months abroad in tropical regions, five months in Mesopotamia and seven months in Egypt. He was brought back to England in June, 1916, suffering from wounds and gas poisoning. We learnt, however, that he had had dysentery six months previously, had been treated, and according to the patient's own words, had been cured. During the time he stayed in hospital he had considerable gastric trouble, with frequent looseness of the bowels.

When his stools were examined, cysts of *E. histolytica* and cysts of *Lambia intestinalis* were found. We do not know whether the dysentery from which the patient suffered in Egypt was bacillary or amoebic, but our findings suggest the latter, in which case he must have relapsed after treatment had been stopped. Unfortunately, we were unable to examine the stools at regular intervals. The record of this untreated case is interesting, however, in that it shows fairly long periods when no cysts were found in the stools, and had subsequent examinations not been made, it might have been supposed that the cysts had disappeared. The record is as follows:—

		June					July						
Date. 1916 .....		30	4	7	10	12	14	18	20	22	25	27	28
<i>E. histolytica</i> cysts ...		+	-	+	-	++	-	-	-	-	-	-	-

  

		August					September								
Date. 1916 ...		1	2	3	4	9	11	12	14	15	9	14	19*	21	26
<i>E. histolytica</i> cysts .....		-	+	-	-	-	+	+	-	-	-	-	+	+	-

\* Amoebae of *E. histolytica* found.

CASE 22. This patient had lived for fifteen months in India, when he was sent to Mesopotamia where he remained for four months. He was invalided to England suffering from pleurisy. On the way home he spent three weeks in Egypt. While in India he had one slight attack of diarrhoea, but did not suffer from this complaint in Mesopotamia or in Egypt or after his return to England.

The first examination of his stools revealed the presence of cysts of *E. histolytica*. In twenty-six subsequent examinations no cysts were found. This is a remarkably interesting case, since it affords a long record of a negative period in a patient who had no treatment.

The record is as follows:—

		June				July				August				
Date. 1916 .....		30	4	5	12	14	20	22	25	27	28	1	2	4
<i>E. histolytica</i> cysts		+	-	-	-	-	-	-	-	-	-	-	-	-

  

		August					September								
Date. 1916 ...		7	8	10	11	12	14	15	17	19	24	30	8	15	18
<i>E. histolytica</i> cysts .....		-	-	-	-	-	-	-	-	-	-	-	-	-	-

CASE 31. This patient had spent the greater part of ten years at sea, and had visited tropical parts of the western hemisphere in particular. On one voyage while on the River Plate he had a short and slight attack of diarrhoea with two stools a day. The exact date of this voyage is unknown to us, but it was certainly more than two years ago. The patient had been in England since August, 1915, and in July, 1916, was admitted to hospital suffering from chronic rheumatism. While in hospital he had no diarrhoea, but generally complained of constipation.

*E. histolytica* and *Lamblia intestinalis* were found in the stools, and in this case the record for these parasites is so interesting that we give it for both. In particular we may point out that the



occurrence of *Lamblia* in the stools alternates to some extent with the occurrence of *E. histolytica*. Only on seven occasions out of sixty-one examinations made did these protozoa occur together. Stools were examined over a long time, and in contrast to the previous case, the record, although it has distinct negative periods, shows remarkably well the persistent occurrence of cysts in an untreated patient. The record of examinations made is as follows:—

		July												
Date, 1916 ...		12	14	17	19	20	21	24	25	26	27	28*	29	31*
<i>E. histolytica</i>														
cysts .....		+++	-	-	++	-	-	-	-	+	+	-	-	-
<i>Lamblia</i> cysts ...		-	+	-	-	+	+	+	-	-	-	+	+	+

		August											
Date, 1916 ...		2*	3	4	5	7	9	11*	12	14	15	16	17
<i>E. histolytica</i>													
cysts .....		-	-	-	-	-	-	-	++	+	++	++	++
<i>Lamblia</i> cysts ...		+	+	+	-	-	-	+	+	-	-	-	-

		August											
Date, 1916 .....		18*	19	21	23	24	25	26	28	29	30	31	
<i>E. histolytica</i> cysts .....		-	-	+	++	++	+	-	++	+	+	-	
<i>Lamblia</i> cysts .....		+	-	-	-	-	-	-	-	-	-	+	

		September											
Date, 1916 .....		1	2	4	5	6	7*	8	11	12	13	14	15
<i>E. histolytica</i> cysts .....		+	-	+	+	+	+	+	+	+	-	+	-
<i>Lamblia</i> cysts .....		+	+	-	-	-	+	-	-	-	-	-	-

		September										October		
Date, 1916 .....		18	19	20	21	22	25	26	27†	28	29	30	2	4
<i>E. histolytica</i> cysts ...		+	+	+	+	+	-	+	+	+	+	+	-	+
<i>Lamblia</i> cysts .....		-	-	-	+	-	+	+	+	-	-	+	+	-

\* *Lamblia* flagellates found. † *E. histolytica* amoebae found.

CASE 84. The patient had been at sea for many years and had visited nearly all the tropical parts of the world, including Egypt, West Indies, East Indies, and West Africa. Unfortunately, we do not know the dates of any of his voyages, and, therefore, cannot form any idea regarding the time when he became infected. Since the beginning of 1915, however, he had not been out of England except for a few months spent in France. He returned from France in July, 1916, suffering from hernia and gun-shot wounds. He never suffered from diarrhoea at any time, and while in hospital complained of constipation.

Cysts of both *E. histolytica* and *E. coli* were found in the stools, the double infection occurring in nine out of twenty examinations made. This case was untreated while under our observation, and the record for *E. histolytica* is as follows:—

		August												
Date.	1916	...	...	...	3	5	8	11	17	19	24	26	29	31
<i>E. histolytica</i> cysts		...	...	+	+	-	-	+	-	+	++	-	+	

  

		September												
Date.	1916	...	...	...	2	5	7	9	12	14	16	19	21	23
<i>E. histolytica</i> cysts		...	...	+	+	+	+	++	++	+	+	+	+	

CASE 126. This patient, a native of Canada, came to England in 1915. Early in 1916 he went to Corfu where he remained three months. He was afterwards stationed at Salonika, but returned to England in August, 1916, suffering from gallstones. On his way home he spent a month in Malta. The patient complained of one attack of diarrhoea while he was in Corfu, but the derangement was apparently slight and lasted only a week.

We were able to make only five examinations of his stools and on the second of these, cysts of *E. histolytica* and *Lamblia intestinalis* were found.

CASE 133. This patient had never been out of England till May, 1915, when he went to France. In November, 1915, he proceeded to Salonika, where he contracted malaria, and was invalided home about the end of August, 1916. The patient never had diarrhoea at any time, but was always very constipated, even during the time he was in the Balkan area.

Examination of the stools showed an infection with *E. histolytica* and *E. coli*, the cysts occurring on some occasions in very considerable numbers. While the patient remained under our observation he received no treatment for dysentery. The *E. histolytica* record is shown in the following table:—

Date.	September														
	8	12	13	14	15	16	18	19	20	21	22	23	25	26	
<i>E. hist.</i>															
cysts ...	+	+++	++	++	-	-	-	-	+	-	+	+	-	-	

CASE 163. This patient went to Egypt in December, 1914. Early in the following year he contracted dysentery. The acute stage lasted a fortnight, with the passage of twenty or more stools a day. The patient remained in bed, received castor oil and gradually got better. In May, 1915, he contracted enteric and was admitted to a hospital in Alexandria. While there a liver abscess was discovered, and the patient coughed much blood, pus and mucus. Emetine injections were administered to the extent of 12 grains. Towards the end of September, 1916, he arrived in England as a convalescent, and after remaining in hospital here a very short time, he was sent to a convalescent camp.

Stools were examined only three times, and on the second examination a fair number of *E. histolytica* cysts were found, thus showing that the patient was still a carrier.

This case is not strictly a 'non-dysenteric,' but it is included in the present report, since the patient was regarded as cured when he left Egypt, and since he was not sent to a dysentery hospital in the usual way for dysenterics.

CASE 168. The patient was in South Africa from 1899-1902, and during that time had no illness. In July, 1915, he left England for the Eastern Mediterranean, and while in the Balkans he suffered from frequent attacks of diarrhoea. These lasted a few days at a time, with seven or eight motions a day, but the patient had no treatment. He contracted malaria and in September, 1916, was invalided home.

The third examination of his stools showed the presence of *E. histolytica*, and on two successive examinations cysts were again found. Seventeen subsequent examinations were made over a period of three weeks, all of which were negative. The patient had a fortnight's treatment with 'alcresta ipecac.' tablets, ten being given every day. This amounts to 19.5 grains of emetine (one tablet contains 0.15 gr. We have not a sufficient number of examinations after treatment had ended to say that the cure is permanent.

CASE 175. The patient had never been out of England until August, 1915, when he went to Mesopotamia. He was there nine months, was wounded and invalided to India. There he remained several months until he was sent home. He never suffered from dysentery or diarrhoea at any time.

On the first examination of his stools the cysts of *E. histolytica* and *Tetramitus* flagellates were found. Subsequently the amoebae

and cysts of *E. coli* were discovered. The patient while under our observation remained untreated for dysentery, and the record for *E. histolytica* is as follows:—

Date.	Sep.				October									
	30	3	5	7	10	12	14	17	19	21	24	26	28	31
<i>E. hist.</i>														
cysts	+	+	++	+	++	—	+	+	+	—	++	+	+	++

CASE 177. This patient had spent many years abroad. He was in Malta from 1893-95, in Egypt in 1896, and then in India till 1899. In 1899 he went to South Africa and remained there a year. From 1900-1903 he was in Ceylon, and then returned to England. He remained in this country until the outbreak of war, when he again went abroad to France and later to Salonika. During all his residence in tropical parts he never suffered from dysentery. Occasionally he had very slight attacks of diarrhoea, but they never lasted more than a day or two at a time. In Salonika he contracted malaria and was invalided home.

When the stools were examined a fair number of cysts of *E. histolytica* were immediately found. A second examination revealed the presence also of *E. coli*. The patient was given alcresta as in Case 168, i.e., he received altogether 19·5 grains of emetine. Subsequent examinations made during a fortnight after treatment had ended were all negative.

CASE 182. This patient went to France in August, 1914. He had never been abroad before. He proceeded to Salonika in November, 1915, and remained there till August, 1916, when he contracted malaria and was sent to Malta. He was in Malta eight weeks before returning to England. He never suffered from diarrhoeic conditions at any time, but was frequently constipated.

The record of the examinations made for *E. histolytica* is as follows. The disappearance of cysts after 19th September is due to treatment which is still being continued.

Date.	September													
	1916	...	...	...	...	5	6	7	19	23	25	27	30	31
<i>E. histolytica</i> cysts	...	...	...	...	...	++	+	—	+	—	—	—	—	—

CASE 198. This patient, 19 years of age, was a native of the West Indies, and had lived there for fifteen years. Then he went to Canada, and came to England in December, 1915. In July, 1916, he went to France and remained there for three months. He returned to England suffering from wounds. He had never had dysentery and had never suffered from diarrhoea.



He remained in hospital a very short time, and was examined for protozoa only twice, and on both occasions fair numbers of cysts of *E. histolytica* were found in the stools. It is probable that he may have been a carrier for several years, as it seems most likely that he would have become infected before he left the West Indies.

CASE 200. This patient had been thirteen months in France. He had never been out of England before the outbreak of war. He had been a miner in the north of England, had no illness to report, and had never suffered from diarrhoea either in France or in this country. He was invalided home at the beginning of October, 1916, suffering from wounds.

He remained in hospital a short time, and only three examinations of stools were made, but on two of these examinations *E. histolytica* cysts were found in considerable numbers.

This case is specially interesting, as it affords the only example in the present records of an infection of *E. histolytica* contracted by a patient who has not visited even the south of Europe. Considering all the circumstances, the infection was most probably contracted in France, possibly by the patient coming into contact with *E. histolytica* carriers from sub-tropical regions.

CASE 223. This patient was out of England for about eighteen months. He spent over a year in Salonika where he contracted malaria, and was invalided home in August, 1916. While in Salonika he had no dysentery, but suffered from slight diarrhoeic conditions for six days.

The patient remained under our observation for five weeks, during which time twenty-eight examinations of the stools were made. A quadruple infection was found, consisting of *E. histolytica*, *E. coli*, *Lambli*a and *Tetramitus*. In four of the first five examinations *E. histolytica* cysts were observed. Treatment with alcresta tablets extended over seventeen days, amounting to 24 grains of emetine, and all examinations after the fifth were negative for *E. histolytica*.

CASE 229. This patient left England for the first time in April, 1915. He contracted dysentery on Gallipoli and was invalided to Egypt, where he remained in hospital a fortnight, and received three injections of emetine. Subsequently he contracted malaria in Egypt and again entered hospital, remaining there for three months. In March, 1916, he proceeded to Salonika. A malarial relapse occurred, and he was invalided home in August, 1916. The patient had no dysentery or diarrhoea after the first attack on Gallipoli.

A triple infection was found consisting of *E. histolytica*, *E. coli* and *Lambli*a. The stools were examined twenty-seven times over



a period of five weeks. In the first four examinations the cysts of *E. histolytica* were found. Thereafter they disappeared, as the patient was given a course of alcresta tablets during seventeen days, amounting to 25 grains of emetine altogether.

CASE 231. This patient was away from England for less than a year. He spent nine months in Salonika and one month in Malta. In Salonika he contracted malaria, and returned to England in August, 1916. He never had dysentery or diarrhoea at any time in his life.

He was under our observation for five weeks, during which time his stools were examined on twenty-eight occasions. Cysts of *E. histolytica* and *E. coli* were found. The former occurred in large numbers on the first four examinations. Alcresta tablets were given over a period of seventeen days, amounting to 22 grains of emetine altogether. By the seventh examination *E. histolytica* cysts had disappeared, and all subsequent examinations were negative.

CASE 232. This patient left England in September, 1915. He arrived in Salonika in November and remained there till August, 1916, when he returned to England. In Salonika he contracted malaria, but never at any time suffered from dysentery or diarrhoea.

On the first examination of his stools a scanty infection of *E. histolytica* was found to be present. Examinations were continued for seven weeks, thirty-two examinations in all being made. All subsequent to the first proved negative for *E. histolytica*, and since this patient had no emetine administered, the case is particularly interesting. It resembles Case 22 in that there was apparently a disappearance of cysts from the stools in an untreated patient.

CASE 234. This patient was out of England for one year during which time he was stationed at Salonika. There he contracted malaria and returned to England in August, 1916. He had no dysentery or diarrhoea. The patient was under our observation for five weeks, and during that time twenty-five examinations of his stools were made.

An infection with *E. histolytica* and *E. coli* was found. The cysts of the former occurred on the first five examinations, and thereafter disappeared as a result of treatment with alcresta. This was given for seventeen days, a total of 24 grains of emetine being administered.

In considering the twenty cases in which infections of

*E. histolytica* were found, we may here point out that thirteen of them remained untreated, while to the other seven emetine was given in the form of alcresta tablets. Although this paper is not primarily concerned with the results of treatment with alcresta, a subject which is considered in another paper in this number (p. 397), it may be mentioned that at least five of the patients to whom the drug was administered have been under observation for a sufficiently long period after treatment had stopped to suggest that a cure had probably been established in each case, viz :—Cases 177, 223, 229, 231 and 234.

Greater interest, however, is attached to the thirteen patients having *E. histolytica* who had no treatment for dysentery during the time they came under our observation. Of these thirteen patients, five, viz., Cases 126, 163, 198, 200 and 232, were examined only a few times, either because the stools were not procurable or because the particular complaint from which the patients suffered necessitated their remaining in hospital only for a very short time. Eight untreated *E. histolytica* cases remain in which the stools were examined frequently for a considerable time. These Cases are 2, 10, 21, 22, 31, 84, 133 and 175, and to each case a table is appended which shows the presence or absence of *E. histolytica* cysts in the stools on the dates on which they were examined. We endeavoured as far as possible to make daily examinations, but various difficulties rendered this impossible. Thus while the records of Cases 10, 31, and 133 are particularly good from this point of view, the regularity of examination in such a case as 21 is not so good. This is all the more unfortunate, since we wished to determine whether the cysts of *E. histolytica* disappear from the stools of untreated patients, and also to determine how many negative examinations an untreated case can give with daily examinations over a considerable period. On these points it is unsafe to draw any general conclusions, for the evidence from the small number of cases at our disposal is insufficient. All we can do is to refer to particular records. In Case 21 it will be observed that two negative periods occur, the first extending over a fortnight and the second over a month, but these periods, particularly the second, might have been considerably reduced had daily examinations been made. A fortnight's negative period again occurs in Case 31, where examina-

tions were made almost daily, and in this particular case it might be almost correctly deduced that a negative period of at least two weeks actually did occur, during which no cysts or amoebae were found in the stools. That this cannot be regarded as general, however, is obvious from a survey of the other records given, where a marked persistence of the cysts is clearly evident.

With regard to patients clearing up without treatment, we can only refer to Cases 22 and 232. In both there is a long period during which no cysts or amoebae were found, and one is tempted to conclude that a 'cure' without treatment had occurred, but this is immediately open to the objection that nothing is known of the presence or absence of cysts on the dates when no examinations were made. In spite of this, however, the two records are extremely remarkable.

Finally we may briefly refer to the fact that in these carriers of amoebic dysentery—most of them of fairly long standing—the vegetative form of the parasite was very seldom observed. This was to be expected, since none of the patients suffered from the acute stage of the disease while they were being examined.

The stools of these twenty carriers were examined in all 395 times, and *E. histolytica* was found on 127 occasions, i.e., approximately once in every three examinations (1: 3.1 exactly). From this ratio alone it may be deduced that either many shorter or several longer negative intervals occurred in the records, since on this assumption alone can the large total number of negative examinations be explained. The above figures, however, include examinations of treated patients who in most instances had negative periods of considerable extent during and after treatment. Confining our attention to the thirteen untreated patients, we find that 235 examinations were made of their stools and *E. histolytica* was found 100 times. The ratio of positive to total examinations becomes in these untreated cases 1: 2.35. This ratio indicates that on the average three examinations are necessary before the presence of *E. histolytica* in an infected patient can be demonstrated with certainty. This is an additional confirmation of the results mentioned earlier in the paper as to the desirability of at least three examinations being made of the stools of all patients suspected of harbouring *E. histolytica*.

It is clear also that the examinations should be sufficient in number and spread over such an interval as to prevent the possibility of even the extreme cases with the long negative periods escaping notice. Since we have established the occurrence of a negative period of a fortnight in an untreated *E. histolytica* case, it would seem desirable that the three examinations should be spread over a period longer than a fortnight in order to make the possibility of missing a case of *E. histolytica* still more remote.

In the 395 examinations of our twenty cases of *E. histolytica* the cysts occurred 126 times and the amoebae only three times.

CASE 116. This patient had spent twelve months in France, and in August, 1916, was invalided home suffering from shell shock. He had never been out of England before the outbreak of the war. Before he joined the Army, he had been engaged as a miner in Yorkshire. At no time in his life had he suffered from dysentery or diarrhoea.

The patient remained under our observation about three weeks during which time seven examinations of his stools were made. On four occasions the cysts of *E. coli* were found in considerable numbers. On five of the seven examinations made there were observed numbers of unusually small cysts which in many respects suggested cysts of *E. histolytica*. The number of nuclei varied from one to four, and even in the fresh condition chromidial blocks could sometimes be discerned. The cysts, however, measured only  $7\mu$  or  $8\mu$  in diameter, and this fact, together with the presence of a fairly large amount of peripheral chromatin in the nucleus and a relatively large karyosome, made a definite determination extremely difficult. Recently, stained preparations of the cysts were submitted to Prof. Warrington Yorke and Mr. Clifford Dobell, and both these authorities were of the opinion that the cysts, in spite of their small size, were those of *E. histolytica*. We are much indebted to both these gentlemen for their help in the diagnosis.

This case is the one referred to in the footnote on p. 371. It affords an additional record of an infection of *E. histolytica* apparently contracted in France, and increases our number of such cases from one to two. This case has been diagnosed too recently to enable us to include it in any of our tables as an *E. histolytica* infection.



**E. DETAILED HISTORIES OF PATIENTS HAVING INFECTIONS  
OF *ENTAMOEBA COLI* APPARENTLY CONTRACTED IN ENGLAND  
OR IN CANADA**

Two patients, Cases 14 and 37, who had never been out of England, came under our notice with an infection of *E. coli*.

CASE 14. The patient was in hospital suffering from a gastric ulcer. He complained of periods of diarrhoea alternating with periods of constipation.

A small infection of *E. coli* was found on the first and only examination we were able to make.

CASE 37. The patient was a sailor, but never touched at any ports other than those of the United Kingdom. For nearly two years he had been somewhere in the North Sea. He was admitted to hospital suffering from enteritis and at the same time complained of slight diarrhoeic conditions.

Amoebae of *E. coli* were found on the first examination of his stool. Nine subsequent examinations were made, and on four of these occasions the cysts were found.

Two patients who had visited Canada were found to have infections with *E. coli*.

CASE 36. This patient was in hospital suffering from a bruised foot. He had no diarrhoea.

On the two occasions when examinations of his stools were made, amoebae of *E. coli* were found. The first examination also demonstrated the presence of cysts.

CASE 194. This patient had been at sea for a year and had once crossed the Atlantic to Halifax. He had no history of diarrhoea, and was in hospital suffering from a twisted ankle.

Cysts of *E. coli* were found in all the four examinations made.

These two cases are quite comparable to the two previously described, with this difference that the patients had been to Canada.

Extended observations have been made on eight patients having an infection of *E. coli*. In seven of these cases negative periods varying from a week to over three weeks, with almost daily examinations, have been found. The record of Case 177 showed an interval of twenty-five days during which seventeen negative examinations for *E. coli* were made. In Case 229 a negative period of twenty-four days occurred, during which interval nineteen examinations were made. In both these cases the infection was small, as is often the case in *E. coli* infections, but, nevertheless, the records indicate the fallacy of concluding that a patient has lost an



*E. coli* infection even when many successive negative examinations are recorded. In Case 22 a few cysts of *E. coli* were found on the first examination, and although there were 26 subsequent examinations of stools over a period of about eleven weeks, cysts were not again observed. It is not unlikely, however, that, had more frequent examinations been made, cysts would again have occurred, and therefore, although it seems probable, we cannot definitely assert that the infection had entirely disappeared. We have to bear in mind also the apparent irregularity of distribution of cysts of this amoeba in faeces, and, in scanty infections in particular, this consideration may always affect any statement regarding the length of time during which no cysts are found in an *E. coli* case. In cases having a fairly heavy infection, the negative periods we have found do not generally exceed a week or ten days. In Case 223 the *E. coli* infection, which proved fairly heavy, was not discovered till the seventh examination. This was followed by a negative period of a week, but thereafter there were frequent recurrences of the cysts.

The stools of the twenty-eight patients having an infection of *E. coli* were examined 303 times altogether, and on 111 occasions the parasite was found, generally in the cyst stage, i.e., approximately once in every three examinations (1 : 2.7). This ratio indicates that at least three examinations are desirable before an opinion can be expressed whether a patient is infected with *E. coli* or not. This has been shown to be true also for *E. histolytica*, where the ratio was 1 : 2.35. In point of fact, the first three examinations provided us with all the cases of *E. histolytica* which we found, but only forty-four of the forty-eight *E. coli* cases were demonstrated by the end of the third examination. This confirms what we have found in examining dysenteries, that *E. coli* is much less regular in its occurrence than *E. histolytica*. The figures obtained from six untreated cases having both *E. coli* and *E. histolytica* infections support this view. These six cases were examined 102 times in all, and on 59 occasions *E. histolytica* was found, while *E. coli* occurred only 24 times.

In comparison with the small number of times when *E. histolytica* amoebae were found, we might here note that the 303 examinations of the forty-eight cases of *E. coli* showed that the amoeboid stage of this parasite was found in the faeces 24 times, while the cysts were present on 105 examinations.

**F. DETAILED HISTORIES OF PATIENTS WHO HAVE NEVER  
BEEN OUT OF ENGLAND AND WHO HAVE INFECTIONS OF  
*GIARDIA (= LAMBLIA) INTESTINALIS***

CASE 6. The patient, a fisherman, had never been away from England or from English waters except for two days which were spent in Holland. We are thus inclined to include him in the above category. He entered hospital suffering from cardiac and gastric trouble, but he had never suffered from diarrhoea.

Two examinations of his stools were made, and on both occasions cysts of *Lambli*a were found in large numbers, on the first a few flagellates also being present. As the patient soon recovered from his ailment, and was discharged from hospital, we were unable to follow the case further.

CASE 15. The patient entered hospital suffering from gastric ulcer. He had previously suffered slightly from diarrhoea, but had no such tendency when he came under our observation. He joined the army in August, 1914, but his gastric trouble had prevented him from being sent abroad, and he had never left England up to the time of our examinations.

While under treatment we were able to make one examination of his stool, in which were found cysts of *Lambli*a in fair numbers.

CASE 238. This patient was called up to serve with the colours on June 5th, 1916. He had six weeks training and then entered hospital to be treated for diarrhoea. Before joining the Army he was a farmer in Shropshire, and had never at any time been out of England. Indeed he had never been further from his own farm than the small market town of that district, which was only four or five miles from his home. For twelve years past he had suffered from attacks of diarrhoea at irregular intervals, and during the more acute attacks had passed four, five, or even more stools daily. The diarrhoea often followed exposure to cold.

He remained under our observation a considerable time, and the first examination showed that he had a *Lambli*a infection, which was soon found to be a heavy one. The complete record of his examinations is as follows:—

		July						
Date. 1916 ...	10	12	13	14	17	18	19	
<i>Lambli</i> a cysts ...	+	+++	++	++	++	++	+++	

		July					
Date. 1916 .....		20	21	22	24	25	26
<i>Lamblia</i> cysts .....		+++	+++	++	++	+++	++

		July				August				
Date. 1916 .....		27	28	29	31	1	2	3	4	5
<i>Lamblia</i> cysts .....		+	-	-	-	-	-	-	-	-

		August							
Date. 1916 .....		7	8	9	10	11	16	17	18
<i>Lamblia</i> cysts .....		+	+	+	+	+	+	++	+

+ = scanty infection of *Lamblia* cysts.

++ = medium infection of *Lamblia* cysts.

+++ = heavy infection of *Lamblia* cysts.

Though the infection from July 12th to 26th was a heavy one, yet a negative period of nine days followed. Afterwards cysts again appeared in the stools, and persisted until the patient passed from under our observation.

His case is of particular interest, as it raises the question of the causation of diarrhoea by *Lamblia intestinalis*. At first sight one is inclined to conclude that his diarrhoea was caused by the *Lamblia* infection and that this is a case of lambliaosis contracted in England. When, however, we consider the results set forth in Table VI of this paper, and see that infections of *Lamblia* are as common in patients who have no record of diarrhoea as in those who have, it becomes necessary to hesitate before stating as a fact that the diarrhoea in this patient was caused by the *Lamblia* infection. It is clear that if a patient is subject to diarrhoea from some other cause the cysts and flagellates of *Lamblia* will be likely to occur in such diarrhoeic stools. It is perhaps useless to speculate further, as we have no prolonged observations as to the connection between the occurrence of *Lamblia* and the condition of the stools. When all the facts are considered it becomes a matter of extreme difficulty to say with certainty that *Lamblia* is the cause of diarrhoea in any

particular case. It is much more difficult than in the case of *Entamoeba histolytica*, for there the severity of the symptoms, the finding of the amoebae in the blood and slime of a dysenteric stool, the ingestion of red blood corpuscles by the amoebae, and many other facts, render it very probable that *E. histolytica* is the primary cause of the dysentery, in spite of the fact that we are now finding a considerable number of cases in which an infection of *E. histolytica* has not caused dysentery, and has in fact appeared to be quite harmless.

Continued observations have been obtained for only five out of the twenty patients infected with *Lambliæ*. Of these five, Case 238 has just been described and his detailed record given. In Case 31 the details of the *Lambliæ* infection are given with those of *E. histolytica* on p. 375. In Case 31 two distinct negative periods occurred extending just under a fortnight, and in Case 238 one such negative period occurred. Since in these cases examinations were made almost daily, it might have been concluded that the infection had disappeared, had not subsequent examinations shown conclusively that *Lambliæ* was still present.

In Case 21, whose record for *E. histolytica* has been given in p. 374, *Lambliæ* cysts were found until July 20th. Thereafter they disappeared, not being found again in the eighteen examinations which followed. This would seem to point to a permanent disappearance of the infection, but this conclusion is scarcely justifiable without more frequent examinations than we were able to make. In the other two cases, 223 and 229, the cysts occurred with almost uninterrupted regularity.

The number of examinations made of the twenty patients having *Lambliæ* infections was 198. *Lambliæ* was found on 113 occasions, i.e., in the ratio 1 positive : 1.75 examinations. The ratio of positives is somewhat higher than in untreated *E. histolytica* cases (1 : 2.35) or in *E. coli* cases (1 : 2.7), and this agrees with our experience from a large number of dysenteric cases, in which we find that *Lambliæ* appears with greater regularity than *Entamoeba histolytica*, or especially *E. coli*. Out of the 113 times when *Lambliæ* was found the cysts occurred on 108 occasions and flagellates occurred on 13 occasions.



## G. ORGANISMS FOUND OTHER THAN PROTOZOA

In addition to the common intestinal protozoa which we found among the patients whose stools we examined, we think it may be of some interest to record the occurrence of cyst-like bodies which were observed in the faeces of seven of the total number of cases examined. These were the vegetable organisms described by Wenyon (1915), and to which the name 'I body' has been given. The infection was pure in four cases, but in the other three cases the organism occurred with various protozoa. The infection was occasionally fairly heavy, and in two cases was remarkably persistent. In four cases the patients had a previous history of diarrhoea, while in the remaining three cases there was none. We are not in a position to remark on the pathogenicity of these organisms, but it may not be without some significance that six out of the seven patients infected had been in the Mediterranean area. In the remaining case the patient had spent a year in France.

Finally there remains to be recorded the occurrence of the eggs of *Trichocephalus dispar* (*Trichiurus trichiura*) in four cases. The infection was always small. Three of the patients concerned had been to sub-tropical parts of the world. One of the infections occurred, however, in a sailor who had never been out of home waters.

In conclusion, we wish gratefully to acknowledge the help we have received from various sources. To Professor Stephens we are indebted for introducing us to the hospital from which we have obtained the material for our investigation and for his continued interest in the work. We wish also to thank Dr. Abram, Mr. Thelwall Thomas and Mr. Jeans for permission to work in the wards under their charge, and to the sisters and nurses of these wards we express our thanks for their kindness and attention in the supply of the specimens examined.

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